THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 104. AUGUST 1866.

XIV.—*Memoir on a new Parasitic Crustacean belonging to the Order* Lernæida, *forming a new Family.* By M. Hesse*.

The object of this memoir is to make known a new Crustacean, which, from the simplicity of its structure and the singularity of its habits, must, I think, excite the curiosity of naturalists. They will judge, from the description we shall give of it, of the embarrassment in which we could not but find ourselves, in the absence of all definite characters, to assign it a place in the classification of organized creatures.

§ 1. *Description.*

It is from 10 to 12 millimetres in length and 2 millims. in breadth; its body, covered with a parchment-like skin, is cylindrical and fusiform. It is essentially retractile in the direction of its length; and the segments of its abdomen, in consequence of the width of their inferior margin, can even become invaginated one within the other. It is divided into *five thoracic and six abdominal segments.*

Seen from the back, the *head* terminates in a rounded point, and presents in the middle a single eye, which, under different degrees of incidence of light, exhibits a play of colours varying from red to blue.

The *thoracic segments* are not very distinct, with the exception of the first two, which are easily recognized. The others are merely indicated by lateral depressions, especially when this part is tumefied by the accumulation of eggs; they increase in depth and width as they approach the base: the last, in particular, is much larger than the rest, is rounded laterally in the middle, and then contracts at its junction with the first *abdominal segment.*

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* Translated by W. S. Dallas, F.L.S., from the 'Annales des Sciences Naturelles,' série 5. tome v. pp. 265–279.

The abdominal segments, when in their normal state (that is to say, neither much contracted nor much extended), are perfectly distinct from each other; they decrease in depth and width from the base to the apex, and are nearly square, being only a little narrower above than below. The last, or sixth, does not at all resemble the others in its form, which is nearly that of a shield, widened at its base, slightly emarginate at the sides, and terminated by two obtuse points furnished with a few hairs. Seen in profile, they show between them a cavity in which the anal orifice opens. However, these forms, which are well marked when they are in their normal state, are extremely variable and become considerably modified according to circumstances.

The *head*, seen in profile, has the frontal margin truncated at the apex and rounded and bent downwards at the sides. Upon it we perceive the antennæ, which are thick, short, cylindrical, and composed of two or three joints, terminated by divergent hairs. Starting from the antennæ, the outer margin of the cephalic envelope descends obliquely in a straight line to go to the superior angle formed by the inflation presented by the orifice of the œsophagus.

Between these two points is the *buccal orifice*, which is placed in the centre of a circular platform slightly hollowed in the middle. This apparatus, which is very complicated, presents the following arrangement:—Immediately below the antennæ, and at the sides of the epistome, there are two pairs of footjaws, which are solid, pectinated, and terminated by a hooked claw; then follows, in the middle, the buccal aperture, composed of a conical proboscidiform tube, which issues from and returns into a cavity formed in the centre of the platform. This tube, which is constructed of a very firm, but very delicate and transparent, membranous tissue, receives its impulsion from two pairs of footjaws, one superior and one inferior, which keep it extended or contracted according as this organ issues from or re-enters the cavity destined for its reception. When the tube is entirely out, we may perceive in its interior a conical appendage, rounded at the end, ascending and descending frequently, like the piston in the chamber of a pump: this is really the *mouth* with its mandibular armament.

The latter is formed of two pairs of footjaws, which are denticulated and trenchant, and furnished with a corneous substance; these, by applying themselves together, can seize and triturate objects. They are, moreover, surrounded by a soft and mobile *labial margin*, which seems to cover them when necessary; lastly, within these organs we see some mandibular palpi, completing this system, which may be employed, according to circumstances, both for suction and mastication.

The whole of this apparatus is strongly attached to the interior by very apparent muscular ligaments, by means of which it is continually issuing from and returning into the proboscis.

Lastly, we also see beneath this proboscis—that is to say, at the base of the buccal apparatus just described—a pair of very strong *footjaws,* composed of three joints, and terminated by a strong, flat, lamellar, and denticulated claw, constructed to dig into or cut objects. These footjaws are curved inwards, so as to be able to reach or even to pass the apex of the buccal orifice, upon which they lower themselves in case of necessity.

We have also remarked that the eye participates in the movement to and fro which causes the buccal apparatus to issue and return—an impulse which acts upon the tegumentary envelope in which it is fixed; we have likewise ascertained that it is capable of an incomplete rotation upon itself.

The *body,* which is very opaque, and, in consequence of its comparative thickness, conceals from sight the details of its interior organization, is surrounded throughout its whole extent by a transparent border, which follows all its outlines. Even with the aid of the compressorium we were unable to detect the movements of circulation, which nevertheless would have been very interesting; we ascertained only that the intestinal tube, which is very voluminous, especially at the middle of the body, passes directly from the œsophagus to the anus, and that the matters contained in it are black, thick, and syrupous; these issue readily from the body when it is touched rather roughly, and then, by spreading in the water, form a tolerably compact network, which remains for some time without dissolving.

It was only by infinite patience, and by taking advantage of an individual kept alive for more than a fortnight and reduced by abstinence until it was nearly transparent, that we succeeded in ascertaining the organization of the mouth and its evolutions. We had previously attempted in vain to detect them by means of the compressorium; its action upon these organs, crushing them, produced nothing but confusion, which prevented our continuing our observations. The lobes of the *liver* are very large, and are contained in the middle of the abdominal cavity. We could not detect the organs of generation. The *ova* are large, enclosed within the most spacious part of the thoracic region, and placed above the intestine while they are still contained in the oviduct. They are arranged in a chain in two or three rows, and form a considerable number of loops or sinuosities; their course may be detected, and is directed towards the orifices placed at the base of the last thoracic segment. When they are expelled from the body, they form a square flat mass; they are enclosed in a special envelope, and agglutinated together. They appear to be excessively caducous; for I have never found them adherent to the body of the Crustacean, but always beside it in its retreat. But as they are contained in an enclosure from which they cannot escape, there is the less inconvenience, in the interest of reproduction, in the fact that they detach themselves so readily from the body of the female.

The *male* of this species is unknown.

The *embryo* resembles that of all the suctorial Crustacea: its body is oval, with the forehead nearly square. The two sides are nearly parallel; and the posterior extremity terminates in a rounded point, presenting neither hairs nor terminal appendages. Of the three pairs of natatory feet with which the body is furnished, the first are simple, and the two others biramose, as in the species just mentioned; all are armed with long flexible setæ destined to assist in natation. The articulations of these feet are very nodulose, and well fitted to facilitate movements. The *buccal apparatus* is proboscidiform and tolerably elongate; it is widened at its orifice, and appears to be furnished with two little jaws. It is erectile, and may lie along the thorax or rise up perpendicularly.

The embryo, seen upon a white ground, appears black, but, when illuminated, it is red. It swims slowly, and with much less activity than those of the species with which we have compared it.

Coloration.—This Crustacean varies much in colour. It is sometimes bright yellow slightly tinged with vermilion; sometimes it is of the latter colour but rather pale, brown, or leather-coloured (*chamois*). The head, the first thoracic segments, and the last segment of the abdomen are always white. The intestine, when full, is deep black; the ova are yellow or brown; the eye, as already stated, red changing to blue.

Habitat. Found, pretty commonly, hidden beneath the scales of the young of the green-streaked Wrasse (*Labrus Donovani**), where it lives as a parasite.

§ 2. *History.*

It is already a long time since, while seeking for parasites on fishes, we first noticed that the young Green Wrasses often presented on the fore part of the sides of the body, not far from the eye and the branchial aperture, a small tumour, the bright-red colour of which contrasted with the green tint of the fish. This peculiarity would not have attracted our attention so much if we had not seen it reproduced almost constantly under similar conditions—that is to say, exclusively upon young fishes*, always of the same species and at the same place, and generally on the right side, never hitherto on both sides. It occurred to us to open one of these tumours, in the expectation of finding some Entozoa in it, in a cyst or scirrous tube; but what was our surprise when we found that we had to do with a being which, although belonging to a higher class, must none the less take a place among the lowest ranks of the Crustacea with which it might be classed.

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* The Breton fishermen call this fish *Castrik*. It is extraordinary that the parasite is absolutely found only upon this species, although there are several in the same genus which have the greatest analogy to each other.

This tumour is of about the size of a lentil, sometimes smaller, rarely larger. Two, or even three, may often be seen upon the same fish; but in this case one is always stronger than the others, and this is usually the first one, that is to say, the nearest to the spot above indicated. On carefully examining the tumour, it is seen to be formed by a certain quantity of scales, which are deranged from their usual symmetrical arrangement, convergent towards a centre, and superposed upon each other in such a manner as to form a projecting and culminating point, at the central summit of which we see a small round hole, evidently opened to establish an issue.

By carefully removing the lateral scales which are at the base of the cone, and have undergone no alteration, we arrive at those which, on the contrary, have undergone a modification. These, which are much thicker than the others, are, so to speak, double-bottomed. If they are torn off, we see, on looking at them from below, that they present a comparatively spacious cavity existing between the upper wall, which is concave, and the lower one, which is flat—an arrangement greatly resembling that of the shells of the *Anomiæ*, if it were not that in these Mollusca the two valves can open and close by means of the hinge placed at the upper part of the shell, whilst in the case now before us these two surfaces are soldered together, and are consequently immoveable.

The scales which have undergone the modifications just mentioned present below (that is to say, on their flat surface) two vertical perforations, of which that placed near the lower margin is always the largest; we also generally detect some other small holes pierced in the upper surface. These scales are applied to the side of the fish by the flat side. When we tear them off, we see at the spot which exactly corresponds with the large perforation above mentioned, a hollow or *sinus* pierced in the flesh, and evidently the result of an erosion produced by the parasite in obtaining its nourishment.

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* We have already had occasion to indicate that it is especially to young fishes that parasites attach themselves, probably as being less able to free themselves. This law appears to be general for all organized creatures: it is probably also for the same reason that old and inferior individuals are also attacked.

All these arrangements having been minutely described, it only remains for us to seek to explain their purpose.

When the double-walled scales are extracted from the place they occupied, and examined on their flat side, the parasite which is enclosed in the cavity existing between the two surfaces may be seen through the aperture pierced in the upper part. Generally it only presents the anterior part of the body at this orifice, and it is difficult to extract it therefrom, seeing that it is retained by a purulent and agglutinative secretion, in the midst of which it is immersed, and which causes it to slip when we endeavour to seize it. This must be done with care, as the least rough contact may wound it and immediately provoke the emission of the substances contained in the intestine.

The ova, which are glued together and form small, square, flat masses, also float in the above liquid.

When taken out of its refuge, the movements of the creature are quick and repeated, but always the same; they are reduced to contractions in a vertical direction and to nutations of the head, which is agitated horizontally to the right and left, so as to give rise to a certain very limited reptation, which sufficiently indicates that it is destined only to furnish the animal with a means of changing its position, but not its place.

The largest of the apertures, which corresponds directly, as has been stated, with the erosion or sinus produced below, leaves no doubt as to its nature or the purpose which has produced it; it is evident that it is by this orifice that our parasite, finding itself in contact with the fish on which it lives, obtains from it its nourishment.

As to the inferior aperture, it seems to us to be destined, by establishing a current, to facilitate the evacuation of the excrementitious matters which might accumulate in this retreat, and to renew the water, which, in consequence of the secretions, might be altered and no longer fit for respiration.

The small apertures pierced in the upper wall are probably intended to correspond with the perforation produced at the apex of the cone formed by the accumulation of the scales, and, by admitting the external water, to facilitate also either the expulsion and dissemination of the embryos, or the access of the male, which, concluding from the analogy of what is known to us, must possess means of locomotion which have been denied to his female.

Lastly, as regards the retreat in which this parasite shelters itself, we shall content ourselves with the following suppositions:—

We suppose that the embryo, at its escape from the egg, being still of extreme minuteness, penetrates by the base of the scale, and introduces itself between the two laminæ which form its two faces; that it raises and separates them slowly in such a manner as to double them, and that by its successive efforts it not only succeeds in creating a space in which it finds a lodging, but acts in such a fashion as to exert upon the scale an abortive influence which, by distorting its structure, modifies its form*. In fact, if we examine the first invasions of this parasite, we find that at first they are confined to a mere long, vertical, ampulliform canal, which afterwards becomes dilated at its base until it presents a capacity of nearly the same dimensions in all directions. The scales which present these proportions are usually not more than two or three in number; it appears that they suffice for the shelter of all the parasites which have to seek a refuge in them; we perceive only, generally in the same line, some small tubular conduits, of the same kind as those of which we have just spoken, which appear to be so many covered ways leading to these principal retreats. Lastly, it appears that these parasites have also a tolerably powerful active force, since they are not only able to make themselves a way between the laminæ of scales, which must present to them a certain resistance, but even perforate them at several points with facility; and the holes which they make are as if pierced by a punch and rounded with a borer.

The vitality of this Crustacean is very great: we have kept it more than a fortnight without giving it any nourishment, and we have found that the strongest pressure did not prevent it from agitating the palpi of its mouth with extreme vivacity for a long time.

§ 3. *Systematization.*

From what we have just said as to the mode of life of this parasite, it will be understood at once that, being sheltered from all contact, and completely protected from external dangers by the safe asylum furnished by its host, it does not require for its protection a solid carapace (accordingly that which covers it is a mere parchment-like envelope); that, having neither to defend itself nor to attack, it has no necessity for either offensive or defensive arms; lastly, that being reduced to a state of almost complete immobility, its useless locomotive appendages have become almost null or rudimentary; but, as it must provide itself with nourishment, it has, on the contrary, been completely furnished with everything that could be necessary to it for this purpose. We remark, in fact, that round the buccal orifice, which, from its proboscidiform structure, may furnish it with the means of absorbing liquids, there exists an auxiliary series of mandibles, arranged circularly and fitted, in case of necessity, to triturate solid objects, and that this organ is not only accompanied by palpi, but also by prehensile feet destined to aid them. Thus, therefore, notwithstanding its apparent nakedness, it is not the less true that it has been very completely provided for its needs.

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* This deformation caused by parasitism need not surprise us, when we consider those produced by *Cynips*, to the mode of life of which that of our parasite presents some singular resemblances. These ways of communication, these roads constructed by the parasite, recall the subepidermic furrows and galleries which are formed by *Sarcoptes scabiei* for a similar purpose.

And thus we have arrived at the most arduous portion of our work, which consists in finding the place in classification which must be assigned to our parasite.

It may be seen, indeed, from the description that we have given of it, that the characters upon which we depend are not very strongly marked; we may add that they were still more difficult to ascertain, in consequence, as already stated, of the opacity of the body of this Crustacean, which is comparatively very thick, and of its cylindrical form, which renders it very unstable on the slide, where it does nothing but roll about; hence, notwithstanding the long practice we have had with the microscope and the compressorium, we are not quite sure of having triumphed over these obstacles. Nevertheless, having operated upon a great number of individuals, and repeatedly verified our observations, we hope that in case we should have committed some errors, these will not be of much importance.

At the first glance, seeing the simplicity of structure of the parasite, we asked ourselves whether we really had to do with a Crustacean. Subsequently, after having attentively examined it, we perceived that it could only belong to this category, and, this being the case, that, from the primitive state of its organs, it must be referred to the lowest rank in the classification of these Articulata, and placed among the *Lernæocerea*. This opinion once admitted, we had to seek for the characters which might justify this view; and the following are those which seem to us to do so.

When we compared it, for example, with *Lernæa branchialis*, we were struck at once by the resemblance which exists between their buccal systems: this part in each is proboscidiform, and composed of a retractile siphon forming a sucker, which shelters itself between the projecting rounded margins protecting the two sides of the aperture of the mouth. We find also that, as in *Lernæa*, this orifice is surrounded by auxiliary feet, and, lastly (and this is a special character of the *Lernæida*), that there exists *all round the body* a transparent border, which accompanies its outline through all its circumvolutions.

Moreover a circumstance which has no less attracted our attention, and which, in our opinion, is most curious, is the resemblance existing in the mode of life of the two parasites.

We know, in fact, that *Lernæa branchialis*, by means of its buccal apparatus, which, as in our parasite, does not appear to furnish any resources for this purpose, and which appears rather destined to draw up liquid materials by suction, succeeds nevertheless, in course of time, in perforating the very thick and resistant first wall of the branchial arch of fishes, in order to lodge its radiciform frontal system in the space occurring between the two plates of this bony part. Our parasite, by similar actions, also, by separating and raising the two laminæ which form the scales of the fish on which it has established itself, succeeds in altering their structure, thus creating for itself a refuge in which it is entirely lodged, and where it lives in peace and sheltered from all dangers.

From what has gone before, and notwithstanding the differences existing between the two species which we compare, we do not hesitate to think that they must belong to the same order; and we form for our parasite a new family, which we characterize as follows:—

Family **Lernæosiphonostomea.**

The females fixed upon their victim by means of the scales of the latter, in which they hollow out a residence. Several footjaws placed around the mouth. Head not horned. Oviferous pouch large and flat.

Genus LEPOSPHILUS[*], nobis.

Body fusiform, divided into ten [eleven] segments, which are very distinct, with the exception of the third and fourth; of these, four [five] are thoracic and six abdominal; all surrounded by a transparent border. *Head* small, rounded at the apex, bearing above a median *eye*, and beneath presenting the buccal orifice, which emits, in a proboscidiform process, some denticulated jaws adapted for the trituration of objects, and laterally three pairs of prehensile footjaws. *Antennæ* very small, rounded at the end, and terminated by divergent hairs. *Abdominal segments* retractile, and capable of invagination; last segments terminated by divergent appendages. Embryo ovulate, furnished with three pairs of feet. Eggs agglutinated, and forming a broad flat mass.

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[*] This name ought evidently to be *Lepidophilus*, and the specific name *Labri*, instead of *Labrei*.

Sp. *Leposphilus Labrei.*

Colour varying from yellow to pale red. Length about 10 to 12 millims. Male unknown.

Inhabits the Green Wrasse, in the scales of which it hollows out a retreat.

XV.—*Observations on the Development and Position of the Hymenoptera, with Notes on the Morphology of Insects.* By A. S. Packard, Junr., M.D.*

The following notes form an abstract of a more extended memoir upon the changes of the insect after leaving the egg, not touching upon the evolution of the embryo.

After the larva has become full-fed, as it is about to enter upon the semipupa state, its body undergoes the following changes:—The thoracic rings and head become more elongated and fuller, so that whereas in the larva the underside of the anterior and posterior halves of the body are closely appressed to each other, now the two halves begin to recede, and the grub, as it lies in its cell, is but half doubled upon itself. With this important change of posture, the whole body becomes more cylindrical and rounded. Thus the sides (arthropleuræ) of the thoracic ring become absorbed, and do not project out from the walls of the body as in the larva; and later still, the corresponding area in the abdomen likewise almost wholly disappears.

The greatest activity, however, is observable about the cephalic portion of the body; for here the greatest differentiation of parts is to occur. The head of the pupa, already partially formed beneath the prothoracic ring, though as yet very small, by its presence still affects very sensibly the form of this region in the larva, the skin of which still remains unbroken, though very considerably distended. The whole length of the head (fig. 1 *a*) and prothorax (fig. 1 *b*) together is now equal to the united length of the head and thorax in the larva originally. To effect this, the larval head is greatly extended forwards, and the prothorax is three times as long as before, and much narrower, the sides converging towards the base of the head. The two posterior thoracic rings are also twice as long as in the larva. On the under (sternal) side the mouth-parts are also elongated; and

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* Communicated by the author, from the 'Proceedings of the Boston Natural History Society,' Feb. 7, 1866.